

# Emerging Infections: Private Concerns and Public Responses

JOSHUA LEDERBERG

The 1990s have been marked by a renewed recognition that our human species is still locked in a Darwinian struggle with our microbial and viral predators. Following decades of complacency born in the era of the antibiotic "wonder drugs," the turning point has



Lederberg

been the tragic frustration from the global ravages of the human immunodeficiency virus (HIV)—one of the simplest of viral constructs—that has so far substantially evaded cure and leaves little latitude for mitigation. The last 2 years have then been accented by several striking episodes of emergence: multidrug-resistant tuberculosis as well as acute coccal infections; the rodent-borne pneumonic hantavirus in the U.S. Southwest and then anew in the Northeast; food- and waterborne outbreaks of *Salmonella* infections, cholera, and illnesses caused by the *Shigella*-like *Escherichia coli* O157. They have also seen remarkable successes in medical epidemiology, e.g., the spectacular application of cutting-edge molecular genetic diagnosis of the new hantaviruses.

The first requirement for finding and applying remedies is a broad understanding that we have a problem. When an indictable culprit can be found, the media and the legal system will leave no stone unturned to assign blame: witness the attention to asbestos in public schools and to the dissemination of aerosols that might harm the ozone layer. But somehow, infectious hazards are not part of the system of environmental

protection, and the person who aerosolizes influenza viruses gets none of the focused attention that would devolve on an emitter of, say, pesticides. The primary culprits of disease are not legal persons, but microbes, so they are beyond the reach of lawsuits, governmental regulation, indeed of national boundaries. We just might have to assume our own personal and collective responsibility to learn how to protect ourselves and to make the investments in public health and research that can lead to shared benefits.

Human activity, of course, plays on the species' competition in more ways than we can count or yet understand. Sheer population density, coupled with movement of people at sonic speed, rapidly mixes microbes and their hosts over a vast range of geography and of social and hygienic status, and of sexual behaviors and parenteral substance use. Hence global HIV! The reappearance of a 1918-like lethal influenza, and it must be only a matter of time for that genetic reassortment to recur, may well lead to an even more explosive spread than was our experience 75 years ago. Our current system of monitoring, authentication, and production of new vaccines probably could not keep pace with the realities of pandemic spread in the jet era. And we have barely scratched the surface in our understanding of genetic variation in viruses, in particular on the interchange of gene segments among strains normally inhabiting different hosts.

Paradoxically, improvements in hygiene, and less-than-perfect vaccines (namely those we generally know how to make), may tax our vigilance even further. Many childhood infections—consider measles, polio, mumps, chicken pox—are generally more lethal when they are first encountered by naive adults. And some of the corresponding vaccines may give less solid lifetime protection than the natural infec-

tions and then require recurrent revaccination. A partially immune herd may be expected to exert more selection for antigenic variants, much as patchy antibiotic therapy encourages the emergence of drug resistance in bacteria. Likewise, improved hygiene may carry a price of immunological naïveté and lessen our streetwise cross-reactions to more serious pathogens. At least it has been speculated that cleaning up bovine tuberculosis may have aggravated vulnerability to human strains, and cross-reacting enteric flora may contribute some immunity to meningococci. It is well-known that antibiotic therapy can open the door to infections by *Candida* spp. and *Clostridium difficile*. These considerations do not gravely alter the cost-benefit equations for hygiene and vaccines, but they do remind us that we are unlikely to find solutions "once and for all" that will enable a future oblivious disregard. Here are the greatest threats: that energetic vaccination programs will be followed by an epoch of neglect and, in turn, by serious resurgences—such as we see at the very moment with measles and diphtheria.

Despite these manifest lessons, the political winds do not seem to be generating a fair reach for public health. Most of the verbiage on health system reform has touched the very real problems of equitable access to care—that is, personal medical encounters after the fact of exposure and disease. Emerging infections challenge existing regimens of care beyond their competence and offer many opportunities for large savings in the health-care burden when preventive public health measures can be discovered and applied. □

*Nobel laureate Joshua Lederberg is a university professor at the Rockefeller University, New York, N.Y.*

Lederberg, J. 1993. Crowded at the summit: emergent infections and the global food chain. *ASM News*, April 1993, p. 162–163.  
Lederberg, J., R. E. Shope, and S. C. Oaks (ed.). 1992. *Emerging infections: microbial threats to health in the United States*. National Academy Press, Washington, D.C.